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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,000	08/18/2003	Ta-Hung Yang	MXIC-P910192	2967
7590 07/26/2004			EXAMINER	
Kenton R. Mullins Stout, Uxa, Buyan & Mullins, LLP Suite 300 4 Venture Irvine, CA 92618			EVERHART, CARIDAD	
			ART UNIT	PAPER NUMBER
			2825	
DATE MAILED: 07/26/2004				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/643,000

Applicant(s)

YANG ET AL.

6X

Examiner

Caridad M. Everhart

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-27 and 29 is/are rejected.
- 7) ☒ Claim(s) 28 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

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Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim Rejections - 35 USC § 102

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The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1,2, 9, 12, 15-18, and 25-26 are rejected under 35 U.S.C. 102(e) as being anticipated by Hung, et al. (US 6,620,564B2).

Hung discloses forming forming a photoresist layer on a semiconductor substrate(col. 4, lines 8-12). A mask is used to expose the photoresist layer (col. 1, lines 37-40 and col. 3,lines1-3). A first exposure process is performed using a first dose and performing a second exposure with a second dose(col. 4, lines 10-23), and developing the photoresist layer to form feature patterns with smaller widths than would have resulted from the first exposure(col. 4, lines 25-37). It is seen in Fig. 2C and 2D that the sidewalls receive some of the exposure during the first and the second dose. In Fig. 2B the areas 290 are a plurality of patternless areas in the mask and are part of the first mask. In Fig. 2D 250 is the second mask(the halftone mask, col. 4, lines 32-37), and the area which is opaque can be seen to be larger than with the first mask. With respect to claim 25, Hung teaches a half-tone mask(col. 4,lines 24-26), which is a phase shift mask as is known in the art. The process takes place using projection exposure

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tool, which is implied by the disclosure of the irradiation method (col. 2, lines 10-34).

Claims 3,4,5,6,7, 8,13,14,21-24, 26, 27, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hung, et al. as relied upon above.

Hung et al is silent with respect to the dose threshold level, the relative areas of the first and second masks, and the relative magnitudes of the first and the second doses. Although Hung et al is silent with respect to the dose threshold level, it would have been obvious to one of ordinary skill in the art at the time of the invention to have applied the doses in the manner recited in the claims because Fig. 2B and 2C show that it is the sum of the doses which form the features of the narrow width in Fig. 2E, so that the first dose should be below the total dose needed. With respect to the relative magnitudes of the first and the second dose, it would have been obvious to one of ordinary skill in the art at the time of the invention to have divided the two in the manner recited in the claims because the magnitudes are variables of the art which one of ordinary skill in the art could determine, in order to obtain the sum of the two which would result in the desired narrow features.

The limitation that the second exposure is performed using a pattern equivalent to that of the first mask may be interpreted to be that the second mask is in a pattern equivalent to the first mask, with only the width of the opening being different, as shown in Fig. 2C and in Fig. 2D, and the mask may be the same mask as the mask is a phase shift mask. With respect to the order of the areas of the masks being greater or lesser, this variation would be within the ordinary

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skill in the art, because the sum of the two doses in the overlap of the doses will be the desired total whether the first area is larger or smaller than the second. Similarly with the magnitudes of the doses, whether the first or the second is larger, it is the sum of the two which must equal the desired quantity, and one of ordinary skill in the art would be able to determine the desired magnitudes of the first and the second dose which would achieve this. With respect to the limitation that the first and second masks are of different materials, it would have been obvious to one of ordinary skill in the art at the time of the invention to have used masks of different materials because one of ordinary skill in the art would have used masks of any material available in the art with the ability to provide the desired patterns and doses to form the narrow features desired.

Claims 1-27, and 29 rejected under 35 U.S.C. 103(a) as being unpatentable over Brueck, et al. (US 5,415,835).

Brueck et al discloses the steps of forming a photoresist layer on a semiconductor substrate(col. 4, lines 31-35) because it is disclosed that there is a photoresist layer on a semiconductor substrate. The limitation "providing a first mask having a first opaque area thereon" is understood to be that there is an opaque area on the mask, not that the mask is on the photoresist layer.

Therefore, Brueck et al disclose providing a mask or two masks which are between the photoresist and the source or sources of irradiation(col. 4, lines 5-18 and lines 23-26 and col. 2, lines 40-44 and col. 6, lines 18-22). A first and a second exposure process at a first and a second dose are carried out (col. 4 lines 52-65) in which it is understood that the constructive or destructive

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interference implicitly taught by Brueck et al (more is said below concerning this aspect) would provide different doses. A development step follows(col. 4, lines 32-36). The purpose is to form finer lines than otherwise possible(col. 2, lines 13-16). With respect to the receiving of a portion of the first and the second dose, it is expected that there will be the addition of the two doses, as there will be constructive interference which results in the addition of the energy as well as the destructive interference which results in the cancellation of the irradiation in certain portions of the photoresist layer. It is implied by for example Fig. 16 that the mask would have a plurality of patternless areas, in order to provide such a pattern as a grating. It is also clear from the figure that the sidewall comprises a plurality of slim features from Fig. 6 and Fig. 8. A phase/amplitude mask is used, which is a disclosure of a phase shift mask(col. 4, lines 25-26). Brueck et al teaches off-axis illumination and teaches illumination at an angle(Fig. 1). The method is done using an exposure tool(Fig. 1). Brueck et al teach not using a second mask in that it is taught that no mask need be used, or only one beam can have a mask(col. 4, lines 25-26). Although Brueck et al is silent concerning a mask without a pattern, it would have been obvious to one of ordinary skill in the art at the time of the invention that a mask without a pattern could be used in order to screen out undesired wavelengths of light from the laser beam because Brueck et al disclose choosing a wavelength of light, and it is well known in the art to block out undesired wavelengths using a material which would function as a mask.

Brueck et al is silent with respect to the exposing of unexposed sidewalls.

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It would have been obvious to one of ordinary skill at the time of the invention that the process taught by Brueck et al includes the exposure of unexposed sidewalls because that the second dose exposes unexposed sidewall regions is understood from the disclosure the same effect of using the mask is obtained by translation for the second dose(col. 4,lines 20-30). It is therefore understood that unexposed areas in the sidewalls would be exposed thereby.

Brueck et al is silent with respect to a threshold level. It would have been obvious to one of ordinary skill at the time of the invention that the first level can be chosen below the threshold for formation of features and the second dose should provide an amount of energy to make the sum of the two doses above the threshold, because the purpose of the method taught by Brueck et al is to have the lines formed by the periodic pattern made by the additive or constructive interference pattern, and this is provided by the areas where the additive interference provides energy above a certain amount.

With respect to the limitations on the relative magnitudes of the doses, it would have been obvious to one of ordinary skill in the art to have chosen the relative magnitudes of the doses because this is a variable of the art which one of ordinary skill in the art can determine. Similarly, the choosing the masks of different materials and dimensions, would be within the ordinary skill in the art because one of ordinary skill in the art would be able to choose masks for the particular application.

Allowable Subject Matter

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Claim 28 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caridad M. Everhart whose telephone number is 571-272-1892. The examiner can normally be reached on Monday through Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


CARIDAD EVERHART
PRIMARY EXAMINER

C. Everhart
7-21-2004